OTHER RED ROCKFISH

by

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Relative to last years' final BSAI SAFE Report, the following changes have been made in the assessment of the Other Red Rockfish.

1) The 2000 landings have been revised and the 2001 landings through September 29, 2001 have been included in the assessment.

2) Catch estimates, by species, from 1977 to the present were constructed from observer data, total catch estimates by management group, and PACFIN records.

3) The Aleutian Islands survey biomass estimates produced on November 2, 2000 were used. This slightly changed the biomass estimates for other red rockfish in the southern Bering Sea in the 2000 survey.

The recommended 2002 ABC levels relative to the 2001 recommendations, assuming identical species complexes as used in 2001, are as follows:

	Eastern Bering Sea		Aleutian Islands	
	2001	2002	2001	2002
Northern/Sharpchin	19 t	19 t	6,745 t	6,745 t
Rougheye/Shortraker	116 t	117 t	912 t	912 t

The recommended 2002 OFL levels relative to the 2001 recommendations, assuming identical species complexes as used in 2001, are as follows:

	Eastern Bering Sea		Aleutian Islands	
	2001	2002	2001	2002
Northern/Sharpchin	25 t	25 t	8,994 t	8,994 t
Rougheye/Shortraker	155 t	156 t	1,216 t	1,216 t

INTRODUCTION

Pacific ocean perch (POP), and four other associated species of rockfish (northern rockfish, *S. polyspinis*; rougheye rockfish, *S. aleutianus*; shortraker rockfish, *S. borealis*; and sharpchin rockfish, *S. zacentrus*) were managed as a complex in the eastern Bering Sea (EBS) and Aleutian Island (AI) management areas from 1979 to 1990. Known as the POP complex, these five species were managed as a single entity with a single TAC (total allowable catch) within each management area. In 1991, the North Pacific Fishery Management Council enacted new regulations that changed the species composition of the POP complex. For the eastern Bering Sea slope region, the POP complex was divided into two subgroups: 1) Pacific ocean perch, and 2) shortraker, rougheye, sharpchin, and northern rockfishes combined, also known as "other red rockfish" (ORR). For the Aleutian Islands region, the POP complex was divided into three subgroups: 1) Pacific ocean perch, 2) shortraker/rougheye rockfishes, and 3) sharpchin/northern rockfishes. In 2000, the other red rockfish complex in the eastern Bering Sea was split into two groups, rougheye/shortraker and sharpchin/northern, matching the complexes used in the Aleutian Islands. These subgroups were established to protect Pacific ocean perch, shortraker rockfish, and rougheye rockfish (the three most valuable commercial species in the assemblage) from possible overfishing. The northern/sharpchin group, while less valuable than other members of the POP complex, represent a significant portion of the aggregate biomass. Each subgroup is now assigned an individual TAC.

The assessment methodology has differed for Pacific Ocean perch and other red rockfish. Pacific ocean perch has historically been the most abundant rockfish in this region and has contributed most to the commercial rockfish catch. Furthermore, the bulk of the research on rockfish has been concentrated on *S. alutus*; relatively little biological or assessment information is available for the other rockfish species. Thus, the Pacific ocean perch are assessed with an age-structured population model, whereas the other red rockfish are assessed with survey biomass estimates.

CATCH HISTORY

Catches of other red rockfish from the eastern Bering Sea and Aleutian Islands since 1993 are shown in Table 1. Shortraker/rougheye and sharpchin/northern removals from the Aleutian Islands region for the same time period are also provided in this table. Examination of the official catch data by fishery reveals that much of the catch of northern rockfish in the Aleutian Islands is bycatch in the Atka mackerel fishery and is discarded, accounting for the high discard rates seen in Table 2.

Estimates of catch, by species, from 1977 to 2001 are shown in Tables 3-6. Catches from the 1977-1989 foreign and joint venture fisheries were produced by computing the harvest proportions within management groups from the North Pacific Foreign Observer Program database, and applying these proportions to the estimated total catch. An identical procedure, using the North Pacific Domestic Observer Program database, was used to produce the domestic catches from 1991-2001, using the total catch estimates summarized by the NMFS Alaska regional office. Catches

from the domestic fishery prior to the domestic observer program were obtained from PACFIN records. Estimated domestic catches in 1990 were obtained from Guttormsen et al. 1992. Estimates of species-specific catch in 2001 were based on observer records through November 1, 2001, and estimated total catch through October 13, 2001. The largest catches in the northern rockfish time series have occurred since 1993 (Table 3), whereas catches of sharpchin rockfish are rarely observed in either the foreign or domestic fisheries (Table 4). Catches of shortraker and rougheye rockfish appear low in the mid-1980's, when the foreign fishery was reduced (Tables 5 and 6).

Estimates of catch by species can be compared to ABC and OFL estimates (when available from recent stock assessments) in order to evaluate whether overfishing may have occurred in the past (Tables 7 and 8). The catch of other red rockfish in the Aleutian Islands is dominated by northern rockfish, and the estimated harvest in recent years has ranged from 1,997 t to 6637 t (Table 7). If species-specific ABCs were in place, the estimated 1999 northern rockfish harvest would have exceeded the ABC level by 24%. The northern rockfish ABC level would have also been exceeded in 1996; the OFL level was not computed for this year.

The rougheye/shortraker group in the Aleutian Islands is composed primarily of rougheye rockfish, whose proportion of the group has varied from 0.57 to 0.92 in recent years. The estimated harvest of rougheye rockfish has occasionally exceeded their harvest limits, sometimes by large amounts. For example, the estimated catch in 2001 (as of October 13th) was 610 t, as compared with ABC and OFL levels of 230 t and 306 t, respectively. Overfishing on rougheye rockfish has also appeared to have occurred in 1996.

Note that observers can report shortraker and rougheye rockfish by species, or with a combined shortraker/rougheye species code. Although the combined code could not be used for estimating proportions, it has accounted for a large percentage of all shortraker and rougheye observed in recent years. For example, approximately 25% of the 330 t of Aleutian Islands shortraker and rougheye rockfish observed in 2000 were assigned to this combined code.

Northern rockfish and shortraker rockfish have been the largest components of the eastern Bering Sea other red rockfish harvest from 1995 to 2000, as these two species ranged from 79% to 94% of the other red rockfish (Table 8). Often the estimated catches of these two species are similar, but because the population size of northern rockfish in recent assessments is estimated to be considerably smaller than shortraker rockfish (based upon average biomass of the post-1986 NMFS surveys), the northern rockfish have smaller harvest quotas. For example, if species-specific ABCs and OFLs were in place, the estimated 2000 catch of northern rockfish of 114 t would have exceeded the ABC and OFL estimates of 34 and 45 t, respectively. The available data for 2001 indicates a similar pattern of potential overfishing for northern rockfish.

The utility of the estimated catch by species is dependent on sampling a reasonable portion of the total catch for species composition. In the Aleutian Islands, the proportion of the total catch, by management group, sampled by observers and identified to species was above 60% from 1994 to 2000, and is above 50% for the available data in 2001. In the eastern Bering Sea, the sampling ratios were above 40% from 1994 to 2000 (except 1997), and were above 70% for the available 2001 data on the two management groups.

The potential overfishing of EBS northern rockfish motivates the identification of locations, target fisheries, and gears contributing to northern rockfish harvests. These descriptive variables were obtained for each BSAI haul in the observer database that caught rockfish from 1994 to 2000. A target fishery, defined as the species group with the largest catch, was assigned based on the species composition in the haul. For species groups with more than one species, such as rockfish, the target was further defined as the species within the group with the greatest catch. Note that this

definition of targeting is based on the total catch, and does not consider discarding. The top ten combinations, per year, of target fishery, gear, and management area that contributed to observed northern rockfish catch from 1998 to 2000 is shown in Table 9. Whereas the observed 1998 catch appeared to be spread across a variety of fisheries, the 1999 and 2000 observed harvests were dominated by the Atka mackerel and pollock fisheries, respectively.

ASSESSMENT METHODS

Absolute Abundance

Biomass estimates for other red rockfish were produced from cooperative U.S.-Japan trawl survey from 1979-1985 on the eastern Bering Sea slope, and from 1980-1986 in the Aleutian Islands. U.S domestic trawl surveys were conducted in 1988 and 1991 on the eastern Bering Sea slope, and in 1991,1994, 1997, and 2000 in the Aleutian Islands (Table 10). An experimental eastern Bering Sea slope survey was also conducted in 2000. The biomass estimate for the eastern Bering Sea has two surveyed components—the eastern Bering Sea slope component and the Aleutian Islands component of the eastern Bering Sea management region.

Other red rockfish are currently managed under Tier 5 of Amendment 56 to the BSAI groundfish management plan, and thus rely solely on survey biomass estimates for information on population size. Because of the high CVs of recent estimates, we thought it prudent to take an average of the survey point estimates to arrive at a recent biomass for each species in each region. In addition, we excluded the data from the cooperative U.S.-Japan trawl surveys (1979-86) from the averages, as these surveys were conducted with considerably different vessels and gear than the U.S. domestic trawl surveys (1988-1997) (Skip Zenger, National Marine Fisheries Service, Seattle, WA, personal communication). Using this approach we estimate the current biomass of northern, rougheye, and shortraker rockfish as follows (sharpchin rockfish biomass is insignificant in both regions):

	Eastern Bering Sea	**Aleutian Islands**
Northern rockfish	425 t	149,898 t
Rougheye rockfish	1,755 t	12,260 t
Shortraker rockfish	3,748 t	30,301 t
Sharpchin rockfish	***** Not common in either area *****	

Reference Fishing Mortality Rates and Yields

Reference fishing mortality rates are based upon estimates of natural mortality. Estimates of M for rougheye, shortraker, and northern rockfish were obtained from Heifetz and Clausen (1991), and the F_{abc} is defined as 75% of M . The acceptable biological catch is obtained by multiplying F_{abc} by the estimated biomass. This procedure results in the following ABCs:

	M	EBS	Aleutian Islands
Northern rockfish	0.060	19 t	6,745 t
Rougheye rockfish	0.025	33 t	230 t
Shortraker rockfish	0.030	84 t	682 t
Sharpchin rockfish		****Not common in either area ****	

The overfishing mortality level for the other rockfish species was calculated as $F_{OFL} = M$, and are summarized by region below:

	EBS	Aleutian Islands
Northern rockfish	25 t	8,994 t
Rougheye rockfish	44 t	306 t
Shortraker rockfish	112 t	909 t
Sharpchin rockfish	****Not common in either area ****	

Given the large CVs of the survey biomass estimates, it is reasonable to ask what the recommended harvest rates would be under the guidelines of tier 6 of Amendment 56 to the BSAI groundfish management plan. Under tier 6, the average catch from 1978-1995 is used as the OFL, and ABC is set to 0.75 times the OFL. The average catches can be obtained from tables 3-6, giving the following Aleutian Islands ABC and OFL values under tier 6:

Species	AI average catch (1978-1995)	ABC	OFL
Northern	1042	782	1042
Rougheye	431	324	431
Shortraker	203	152	203

Thus, under tier 6 the AI northern rockfish and shortraker rockfish ABCs are reduced dramatically relative to tier 5, whereas the rougheye rockfish ABC is increased slightly. The eastern Bering Sea ABC and OFL values under tier 6 are:

Species	EBS average catch (1978-1995)	ABC	OFL
Northern	161	121	161
Rougheye	130	98	130
Shortraker	164	123	164

Thus, under tier 6 the ABC for all three species are increased relative to their values under tier 5. It is recommended that other red rockfish remain in the tier 5 category, in part because the average catches from 1978-1995 does not reflect recent catches for some species, particularly northern

rockfish. However, future research should continue to investigate survey methodologies that could reduce the variances of biomass estimates.

A potential problem with assigning a harvest quota to complexes of two or more species is that members of the complex may experience overfishing while the group harvest quota is not exceeded. The division of the other red rockfish in the EBS into two separate complexes for 2001 partially addresses this concern by reducing the number of species that share a single harvest quota. In the 2000 SAFE, the BSAI Plan Team recommended that a single BSAI-wide ABC be applied for each species of other red rockfish (excluding sharpchin rockfish, whose catches in both the survey and fishery data is minimal), partitioned by management area in proportion to recent survey biomass estimates. This recommendation was supported by preliminary data indicating that northern rockfish separated by large distances in the north Pacific did not show heterogeneity in mtDNA or microsatellite DNA (Dr. Tony Gharrett, University of Alaska, pers. comm.), although the samples sizes were small and these results do not necessarily imply lack of population structure. Additionally, the bulk of EBS northern rockfish harvest appears to occur in the southern Bering Sea area rather than the EBS slope, and thus is close to Aleutian Islands management area. Although the North Pacific Fishery Management Council adopted this recommendation, its implementation was hindered by the large amount of shortraker and rougheye rockfish not identified to species by fishery observers. Additionally, single-species harvest levels of rougheye and shortraker rockfish will not be available in 2002 because of these sampling issues. However, if single-species management were to be implemented in 2002, the area-wide ABCs and OFLs would be:

	ABC	OFL
Northern rockfish	6,764 t	9019 t
Rougheye rockfish	262 t	350 t
Shortraker rockfish	766 t	1021 t

The recommended ABC and OFL levels, assuming identical species complexes as those used in 2001, are:

	Eastern Bering Sea		Aleutian Islands	
	ABC	OFL	ABC	OFL
Northern/Sharpchin	19 t	25 t	6,745 t	8,994 t
Rougheye/Shortraker	117 t	156 t	912 t	1,216 t

REFERENCES

Guttormsen, M., R. Narita, J. Gharrett, G. Tromble, and J. Berger. 1992. Summary of observer sampling of domestic groundfish fisheries in the northeast Pacific ocean and eastern Bering Sea, 1990. NOAA Tech. Memo NMFS-AFSC-5. 281 pp.

Heifetz, J. and D. Clausen. 1991. Slope rockfish. *In* Stock assessment and fishery evaluation report for groundfish report for the 1992 Gulf of Alaska groundfish fishery. North Pacific Fishery Management Council, P.O. Box 103136, Anchorage, AK.

Table 1. Estimated removals (t) of the sharpchin/northern (SCNO), shortraker/rougheye (SRRE), and other red rockfish (ORR; consists of the sum of the SCNO and SRRE complexes) from the eastern Bering Sea and Aleutian Islands regions. Prior to 2001, harvests in the eastern Bering Sea were managed with the ORR complex. Unless otherwise noted, catch data were obtained from summaries produced by the NMFS Alaska regional office.

	Eastern Bering Sea			Aleutian Islands	
Year	SCNO	SRRE	ORR	SCNO	SRRE
1993			1226**	4,486	1,130
1994			129	4,667	925
1995			343	3,873	559
1996			207	6,653	959
1997			230	1,997	1,043
1998			97	3,674	661
1999			227	5,255	485
2000			245	4,737	443
2001*	141	27		5,951	677

*Estimated removals through October 13, 2001.
**Source: Blend catch estimates.

Table 2. Estimated retained, discarded, and percent discarded of other red rockfish (ORR), sharpchin/northern (SC/NR), and shortraker/rougheye (SR/RE) from the eastern Bering Sea (EBS) and Aleutian Islands (AI) regions. Prior to 2001, harvests in the eastern Bering Sea were managed with the ORR complex. Unless otherwise noted, catch data were obtained from summaries produced by the NMFS Alaska regional office.

Species Area	Group	Year	Catch Retained	Discard	Total	Percentage
EBS	ORR	1993**	916	310	1226	25.2%
		1994	28	101	129	78.3%
		1995	273	71	344	20.6%
		1996	58	149	207	72.0%
		1997	57	173	230	75.2%
		1998	41	71	112	63.4%
		1999	67	161	228	70.6%
		2000	107	139	246	56.5%
EBS	SC/NO	2001*	15	126	141	89.4%
EBS	RE/SR	2001*	16	11	27	40.7%
AI	SC/NO	1993	320	4,166	4,486	92.9%
		1994	798	3,870	4,668	82.9%
		1995	1,207	2,665	3,872	68.8%
		1996	2,269	4,384	6,653	65.9%
		1997	145	1,852	1,997	92.7%
		1998	459	3,289	3,748	87.8%
		1999	521	4,735	5,256	90.0%
		2000	273	4,464	4,737	94.2%
		2001*	171	5,780	5,951	97.1%
AI	SR/RE	1993	733	397	1,130	35.1%
		1994	700	224	924	24.2%
		1995	455	103	558	18.5%
		1996	752	208	960	21.7%
		1997	732	310	1,042	29.8%
		1998	449	235	684	34.4%
		1999	293	191	484	39.5%
		2000	258	183	441	41.5%
		2001*	448	229	677	33.8%

* Estimated removals through October 13, 2001.
** Source: Blend catch estimates.

Table 3. Catches of northern rockfish in the BSAI area, obtained from the North Pacific Groundfish Observer Program, NMFS Alaska Regional Office, and PACFIN. Aleutian Islands domestic catch for 1991 was not used because of a discrepancy between observed and estimated total catch.

	Eastern Bering Sea			Aleutian Islands			
Year	Foreign	Joint Venture	Domestic	Foreign	Joint Venture	Domestic	Total
1977	4			3,232			3,236
1978	21			549			570
1979	61			195			256
1980	49	9		221			279
1981	20	0		92			112
1982	63	8		177	0		248
1983	10	32		47	0		89
1984	26	6		11	185		229
1985	5	1		0	189		195
1986	5	41	15	0	193	15	270
1987	1	45	31		248	60	385
1988		4	36		438	55	534
1989		12	66		0	306	384
1990			247			1,235	1,481
1991			455				455
1992			328			1,541	1,868
1993			959			4,480	5,440
1994			47			4,666	4,712
1995			286			3,858	4,144
1996			116			6,637	6,753
1997			118			1,997	2,114
1998			47			3,674	3,721
1999			144			5,254	5,399
2000			114			4,737	4,851
2001*			141			5,951	6,092

* Estimated removals through October 13, 2001.

Table 4. Catches of sharpchin rockfish in the BSAI area, obtained from the North Pacific Groundfish Observer Program, NMFS Alaska Regional Office, and PACFIN. Aleutian Islands domestic catch for 1991 was not used because of a discrepancy between observed and estimated total catch.

	Eastern Bering Sea			Aleutian Islands			
Year	Foreign	Joint Venture	Domestic	Foreign	Joint Venture	Domestic	Total
1977	0			0			0
1978	0			0			0
1979	1			16			17
1980	3	1		0			4
1981	2	0		0			2
1982	5	0		18	0		23
1983	0	0		1	0		1
1984	0	0		0	0		0
1985	0	0		0	0		0
1986	0	0		0	0		0
1987	0	0			0		0
1988		0			0		0
1989		0			0		0
1990							0
1991			3				3
1992			2			0	3
1993			1			6	6
1994			0			1	1
1995			0			15	15
1996			0			16	16
1997			1			0	1
1998			0			0	0
1999			3			1	4
2000			0			0	0
2001*			0			0	0

* Estimated removals through October 13, 2001.

Table 5. Catches of shortraker rockfish in the BSAI area, obtained from the North Pacific Groundfish Observer Program, NMFS Alaska Regional Office, and PACFIN. Aleutian Islands domestic catch for 1991 was not used because of a discrepancy between observed and estimated total catch.

	Eastern Bering Sea			Aleutian Islands			
Year	Foreign	Joint Venture	Domestic	Foreign	Joint Venture	Domestic	Total
1977	0			26			27
1978	713			131			844
1979	372			977			1,349
1980	380	0		74			455
1981	258	0		315			573
1982	242	0		379	0		621
1983	145	0		89	1		235
1984	54	0		28	0		83
1985	19	0		1	0		21
1986	2	2	14	0	0	12	30
1987	0	0	28		0	36	64
1988		0	31		0	37	69
1989		0	58		0	130	188
1990			116			546	662
1991			157				157
1992			72			292	364
1993			184			257	440
1994			55			174	230
1995			43			178	222
1996			68			109	177
1997			79			85	164
1998			39			137	176
1999			69			102	171
2000			112			187	300
2001*			18			67	85

* Estimated removals through October 13, 2001.

Table 6. Catches of rougheye rockfish in the BSAI area, obtained from the North Pacific Groundfish Observer Program, NMFS Alaska Regional Office, and PACFIN. Aleutian Islands domestic catch for 1991 was not used because of a discrepancy between observed and estimated total catch.

	Eastern Bering Sea			Aleutian Islands			
Year	Foreign	Joint Venture	Domestic	Foreign	Joint Venture	Domestic	Total
1977	1			153			155
1978	66			364			430
1979	637			999			1,636
1980	94	0		265			359
1981	166	0		493			658
1982	124	0		189	0		312
1983	53	0		56	2		111
1984	79	0		31	4		114
1985	18	0		1	9		27
1986	3	1	48	0	2	19	74
1987	1	2	96		3	76	179
1988		1	110		5	70	185
1989		2	202		0	381	585
1990			369			1,619	1,988
1991			83				83
1992			65			1,174	1,239
1993			82			873	956
1994			27			751	778
1995			13			381	394
1996			23			850	873
1997			33			958	991
1998			11			524	535
1999			10			383	393
2000			18			256	274
2001*			9			610	619

* Estimated removals through October 13, 2001.

Table 7. Catch of other red rockfish in the Aleutian Islands from 1995 to 2001, with reported species ABC and OFL levels where available. The SR/RE species code includes both shortraker and rougheye rockfish.

	Species	Observed Catch	Proportion of Sp. Group	Estimated total catch	ABC	OFL
2001*	Northern	3218.00	1.0000	5951.00	6745	8994
	Sharpchin	0.00	0.0000	0.00		
	Rougheye	347.88	0.9008	609.87	230	306
	Shortraker	38.29	0.0992	67.13	682	909
	SR/RE	64.04				
2000	Northern	3995.77	1.0000	4736.85	5153	6870
	Sharpchin	0.13	0.0000	0.15		
	Rougheye	141.91	0.5768	255.54	239	319
	Shortraker	104.11	0.4232	187.46	646	861
	SR/RE	83.77				
1999	Northern	4423.65	0.9998	5254.21	4230	5639
	Sharpchin	0.67	0.0002	0.79		
	Rougheye	285.04	0.7894	382.87	405	540
	Shortraker	76.04	0.2106	102.13	560	747
	SR/RE	39.28				
1998	Northern	2896.63	0.9999	3673.61	4230	5639
	Sharpchin	0.30	0.0001	0.39		
	Rougheye	347.62	0.7926	523.90	405	540
	Shortraker	90.97	0.2074	137.10	560	747
	SR/RE	73.48				
1997	Northern	1424.39	0.9999	1996.76	4358	5810
	Sharpchin	0.17	0.0001	0.24		
	Rougheye	723.73	0.9185	957.99	440	587
	Shortraker	64.23	0.0815	85.01	498	664
	SR/RE	6.49				
1996	Northern	4540.15	0.9975	6636.64	5810	NR
	Sharpchin	11.19	0.0025	16.36		
	Rougheye	519.52	0.8866	850.27	587	NR
	Shortraker	66.44	0.1134	108.73	664	NR
	SR/RE	8.79				
1995	Northern	2376.14	0.9961	3857.93	5670	NR
	Sharpchin	9.28	0.0039	15.07		
	Rougheye	195.61	0.6808	380.56	632	NR
	Shortraker	91.72	0.3192	178.44	590	NR
	SR/RE	1.58				

* Observer data through November 1, 2001; total catch estimate through October 13, 2001

Table 8. Catch of other red rockfish in the eastern Bering Sea from 1995 to 2001, with reported species ABC and OFL levels where available. The SR/RE species code includes both shortraker and rougheye rockfish.

	Species	Observed Catch	Proportion of Sp. Group	Estimated total catch	ABC	OFL
2001*	Northern	118.42	0.9997	140.96	19	25
	Sharpchin	0.03	0.0003	0.04		
	Rougheye	6.24	0.3196	8.63	32	43
	Shortraker	13.28	0.6804	18.37	84	112
	SR/RE	4.27				
2000	Northern	61.64	0.4668	114.37	34	45
	Sharpchin	0.11	0.0008	0.20		
	Rougheye	9.82	0.0744	18.22	35	47
	Shortraker	60.48	0.4580	112.21	125	167
	SR/RE	15.95				
1999	Northern	86.84	0.6365	144.48	537	716
	Sharpchin	1.83	0.0134	3.04		
	Rougheye	6.21	0.0455	10.33	51	68
	Shortraker	41.56	0.3046	69.14	185	247
	SR/RE	4.91				
1998	Northern	28.77	0.4841	46.96	537	716
	Sharpchin	0.05	0.0009	0.09		
	Rougheye	6.91	0.1163	11.28	51	68
	Shortraker	23.69	0.3987	38.67	185	247
	SR/RE	8.55				
1997	Northern	24.95	0.5109	117.51	788	1051
	Sharpchin	0.12	0.0025	0.58		
	Rougheye	6.97	0.1426	32.81	56	75
	Shortraker	16.79	0.3439	79.10	207	276
	SR/RE	4.66				
1996	Northern	61.27	0.5606	116.04	1051	NR
	Sharpchin	0.01	0.0001	0.01		
	Rougheye	12.05	0.1103	22.82	75	NR
	Shortraker	35.98	0.3291	68.13	276	NR
	SR/RE	0.93				
1995	Northern	159.10	0.8352	286.48	1051	NR
	Sharpchin	0.00	0.0000	0.00		
	Rougheye	7.33	0.0385	13.20	75	NR
	Shortraker	24.05	0.1263	43.31	276	NR
	SR/RE	0.93				

* Observer data through November 1, 2001; total catch estimate through October 13, 2001

Table 9. Observed catch (t), per year, of northern rockfish in the eastern Bering Sea from the top ten combinations of fishery, area, and gear from 1998-2000.

			Year		
Target	Area	Gear	1998	1999	2000
POP	518	Bottom Trawl		11.04	
POP	531	Bottom Trawl			3.49
Pollock	517	Bottom Trawl	1.81		
Pollock	517	Bottom Trawl			2.92
Pollock	517	Pelagic Trawl			32.90
Pollock	517	Pelagic Trawl		2.05	
Pollock	518	Bottom Trawl		2.27	
Pollock	519	Bottom Trawl	1.30		
Pollock	519	Bottom Trawl		1.54	
Pollock	519	Pelagic Trawl	1.22		
Pacific cod	517	Bottom Trawl	1.00		
Pacific cod	517	Bottom Trawl			5.05
Pacific cod	517	Longline	1.96		
Pacific cod	517	Longline			0.90
Pacific cod	517	Longline		1.69	
Pacific cod	517	Pelagic Trawl			0.50
Pacific cod	519	Bottom Trawl	1.32		
Pacific cod	519	Bottom Trawl		1.26	
Pacific cod	531	Bottom Trawl			1.82
Pacific cod	531	Longline			1.11
Northern	517	Bottom Trawl	5.32		
Northern	517	Bottom Trawl			11.35
Northern	519	Bottom Trawl	2.58		
Northern	519	Bottom Trawl		8.29	
Northern	531	Pelagic Trawl		3.20	
Light Dusky	531	Longline	1.39		
Atka mackerel	517	Bottom Trawl		2.14	
Atka mackerel	519	Bottom Trawl	3.53		
Atka mackerel	519	Bottom Trawl		44.52	
Arrowtooth	519	Bottom Trawl			0.48
Total (top ten combinations)			21.43	78.00	60.50
Total Observed Catch			28.77	86.64	60.61
Total Estimated Catch			46.96	144.48	114.37

Table 10. Estimated biomass (t) of rougheye, shortraker, and northern rockfishes from the NMFS bottom trawl surveys. For the Aleutian Islands surveys since 1991 and the eastern Bering Sea surveys since 1988, the coefficient of variation (CV) is shown in parentheses.

Eastern Bering Sea (EBS) Surveys

	Rougheye		Shortraker		Northern
1979	1,053		1,391		53
1981	816		3,571		23
1982	605		5,176		24
1985	1,716		4,010		--
1988	876	(0.32)	1,260	(0.43)	4
1991	884	(0.30)	2,758	(0.38)	--

Aleutian Islands portion of EBS Area I

	Rougheye		Shortraker		Northern	
1980	922		1,020		341	
1983	2,830		13,079		1,516	
1986	3,511		6,478		67,394	
1991	676	(0.12)	1,925	(0.66)	582	(0.63)
1994	1,208	(0.49)	1,959	(0.78)	855	(0.60)
1997	561	(0.66)	2,428	(0.97)	204	(0.68)
2000	1054	(0.29)	645	(0.75)	49	(0.40)

Aleutian Islands Surveys

	Rougheye		Shortraker		Northern	
1980	21,885		15,963		43,312	
1983	20,582		27,913		43,458	
1986	48,843		19,345		133,662	
1991	10,445	(0.48)	21,778	(0.69)	214,673	(0.16)
1994	13,344	(0.28)	26,230	(0.22)	92,433	(0.48)
1997	11,035	(0.22)	36,058	(0.27)	87,186	(0.31)
2000	14,205	(0.23)	37,136	(0.45)	205,300	(0.29)